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ABSTRACT

Reported were performance data for over 350 hearing impaired children who were exposed to the perceptual training filmstrips from the Language Improvement to Facilitate Education (LIFE) program. Research on the visual perception of deaf persons was reviewed and found to support the following conclusions: there appears to be a relationship between hearing loss and deficient visual perceptual abilities; decreased visual perception skills have a positive relationship with poor reading abilities; remedial training in perceptual skills can enhance reading abilities; and the theoretical framework proposed to explain these effects involves a breakdown in sensory integration between the visual and auditory sensory mode. It was explained how visual perceptual skills form an important part of a language development program. Data for each filmstrip was tabulated to indicate the number of students (3- to 13-years-old) on which the data was tabulated, the mean number of errors, the standard deviation of errors, and the range of errors. Other data indicated the percentage of 6-year-old children making specific number of errors and the cumulative percentages by units and sections of the LIFE program. Appendixes included outlines of field test filmstrips, the perceptual training contents of the field test filmstrips, examples of association frames in visual perceptual areas, field test filmstrips, examples of association frames in visual perceptual areas, field test reporting forms, revisions made on the visual perceptual filmstrips following field evaluation, and a comparison of the field test filmstrip identification and the General Electric/LIFE filmstrip identification. (GW)

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VISUAL-PERCEPTUAL TRAINING

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VISUAL PERCEPTION AND THE DEAF: AN OVERVIEW

Educators of the deaf and educational researchers have been trying, for more than a decade, to develop adequate methods for teaching the deaf language and reading. Much research has shown that many deaf children are retarded in their language abilities because of poorly developed visual-perceptual skills which hearing children have adequately developed by the age of five or six. Even hearing children with reading problems have been found to be perceptually retarded. Thus, research has taken the direction of attempting to discover which perceptual processes are involved and what interconnections the auditory and visual systems have physiologically and developmentally.

The prevailing notion until recent times was that compensation occurs in one distant sense (vision) with loss in another (audition). Most data tends to contradict rather than support the idea of physiological compensation on the part of the remaining distant sense when applied to the hearing-impaired. Frisina (1963) reports that studies in visual acuity indicate that hearing-impaired children have a greater incidence of visual deviations than normals. Visual perception studies (Myklebust & Brutten, 1953, and Larr, 1956), involving figure-ground tests, show that the deaf do not surpass the hearing in performance and, in fact, the deaf do poorer than the hearing according to one study. The data reviewed show no indication of superiority of hearing-impaired over hearing children in various visual skills. Tests for visual memory (Blair, 1957) show favorable results to some extent for the deaf over hearing subjects. Visual memory is, however, the only area where the deaf have been shown to have some advantage over hearing individuals. However, the results were not significant and may be questionable.

Various theoretical viewpoints have been invoked to account for visual problems which may be associated with deafness. The most prevalent theories (Piaget, 1952; Brunner, 1964; Hebb, 1949; and Delacato, 1959) deal with intersensory integration in which perceptual development occurs through mutual development of all the senses. The theories indicate that any break in the connections between various senses will have an adverse effect on the development of other senses.

Studies as early as Braly (1937) showed visual defects in deaf children. This was the first intensive study of such visual defects. Using 422 children between 5 and 21 years of age in a deaf residential school, he tested for visual defects using the Snellen Chart Test of Visual Acuity. The results showed 38% of the subjects had visual defects. This was considerably higher than those found in normal children of comparable age. Stockwell (1952) studied 960 students at a residential school for the deaf using the Snellen Chart and ophthalmological examinations. Results showed 45% of the subjects with visual defects as contrasted with 15% for a similar sample of normal children. Myklebust and

Brutten (1953) also used deaf residential school children. Using 191 subjects, they tested for visual defects using the Keystone Visual Survey Tests. Their results showed 51% with one or more defects associated with fusion, occulomotor capacity, and acuity. They found 30% with two or more defects. In their sample, females had more defects than males but the difference was not significant. The results were significantly higher, however, than normals. The most prevalent defect found was hyperopia - far-sightedness. The researchers point out that the results could not be interpreted as entirely indicative of sensory defects since the tests assume normal perceptual functioning. Thus failure of the tests may indicate either perceptual or sensory defects. The results of this study tend to follow Gesell et al, (1949) who stated the distance vision doesn't mature until 7 years of age. The subjects used by Myklebust and Brutten (1953) were either congenital deaf or lost their hearing before 7 years. Thus, it is quite possible that the hearing loss had a profound effect on the formal development of the visual system. Brabner (1965) also showed that hearing loss occurring early in life results in a sensory retardation which effects visual learning with respect to certain stimuli. His subjects had no trouble recognizing tachistoscopically presented continuous line patterns while they could not discriminate dot patterns even when additional dots were added to the stimulus picture. The data indicates some breakdown in perceptual processes.

Other studies dealing with visual perception also have shown that the deaf are more inferior to normals. Blair (1957) hypothesized that a severe disturbance of one sensory area (hearing) would influence effectiveness in another (vision). He also intended to explore the area of sensory compensation. He used 53 deaf children aged 7 to 12-1/2 years and a control group of equal numbers of hearing children. Each child was given a battery of perceptual tests which included the Chicago Non-Verbal Examination, Knox Cube test, Memory-for-Designs test, Object Location test and Four Memory Span tests. The results show that the deaf were significantly inferior to the hearing in Memory Span tests while they were superior to the hearing children in the Knox Cube, Memory-for-Designs, and Object Location tests. He concluded that memory span involves a type of abstract mental process on which discrete yet related units are organized into meaningful sequences, and thus the deaf are lacking in auditory memory which is necessary in forming good visual memory. However, he states that the deaf compensate for hearing loss with increased visual skills. This is the only viewpoint in favor of compensation. All later studies question this conclusion. Thompson (1964) studied the development of visual perception in hearing-impaired children. Ninety subjects aged 6-12 were divided into three groups: 30 - congenital deaf, 30 acquired deafness before 7 years, and 30 normals. They were tested on three visual discrimination tasks involving depth perception, letter-like form discrimination, and Muller-Lyer illusion size discrimination. The hearing group outperformed both hearing-impaired groups; while distinct differences were found between the two deaf groups. The results showed that perceptual retardation decreases with onset of the acquired deafness, and total performance for the deaf increases with age. Thompson concluded that the development of visual perception may be autonomous from auditory deficit, although the rate of development is slower. He also points out that the learning experience is crucial. If the child receives an enriched type of visual experience, he will show better performance on the tasks.

Marshall (1968) performed a study to determine whether deaf children had poorer visual perception skills than normals at school entrance. Using 227 deaf children ranging in age from 2.3 to 8.6 years, she administered the Frostig Developmental Test of Visual Perception and compared the scores to those of normal children in the standardization sample. The deaf children were not inferior to normals if they had entered school at three years of age. However, the greater the delay in school entry, the more retarded the child was in visual perception skills necessary in learning to read.

Finally, Hanson (1969), found a developmental lag of measurable visual perception ability in young deaf children. She used tests standardized on a hearing population to determine if they are valid indicators for the deaf. These tests included the Bender-Gestalt test for young children, the Frostig DTVP, subtests of the Illinois Test of Psycholingistic Abilities, Gates Primary Reading Test, and the Columbia Mental Maturity Scale. The best indicators were the Binder-Gestalt and the Frostig. She recommends special training in visual perception for deaf children in visual memory where the greatest lag (43%) was found.

Recent research has shown that deficiencies in visual perception skills are closely associated with poor reading abilities. A study relating visual perception skills to reading (Feldmann, 1961) showed that reading skills were positively correlated to scores on visual perception tests, age and experience. Her results suggest that poor synchronization of visual perception development and reading skills might impede school achievement. Cohen (1966) placed 155 first grade pupils who had low perceptual and reading test scores on a remedial training program using the Frostig materials. The students in the experimental group had significant gains on perceptual scores. Although no significant improvement in reading skills were found, the training did decrease the deficit between the perceptual and reading scores. Faustman (1966) showed that perceptual training in kindergarten caused her experimental group to have higher initial reading abilities than controls. Krippner (1968) studied 146 poor readers with WISC IQ's of 87 to 112. He found that poor visual perceptual skills were the most common etiological factor in cases of reading disability. Thus, it would appear that reading disabilities can be traced to poor perceptual skills and that remedial training in visual perception will improve reading ability.

Rawls (1967) studied 22 deaf children who received individual training sessions designed to enhance visual perception. Results after testing on aptitude tests for school readiness were significant. Thus perceptual training enhanced school readiness for deaf children and therefore provided the children with skills necessary for learning to read. Finally, Doehring and Rosenthal (1969) studied visual perception speed in deaf children. This is a necessary trait for adequate reading abilities. Previously (Doehring & Rosenthal, (1960) the experimenters demonstrated that young deaf children were less accurate than hearing children in recognizing briefly exposed letters, trigrams and words. In the latter study, 50 hearing and 50 deaf children in 4 groups of 25 equated for age, sex, and performance I.Q. were used. Each group was administered a test of visual perceptual speed which included 13 subtests varying in stimulus complexity and verbal content. The results showed that hearing children scored significantly higher than the deaf on 9 out of 13 subtests. The data of both studies indicates that deaf children may be slow in identifying symbolic and sequential printed material, perhaps due to language retardation and that

they may be found deficient in a variety of perceptual skills.

Attempts have been made at theorizing the causes of the perceptual and reading deficiences of the hearing impaired. Hurley (1966) states:

> ....reading development depends on coordination of vision and audition. Any breakdown in this coordination at a non-meaningful psycholinguistic level has already been demonstrated to be significantly related to reading achievement.

Eisenberg (1963) reported that audiologists and speech therapists are finding that non-verbal (visual-perceptual-motor) disabilities are frequently closely associated with language and auditory dysfunctions. The prevailing theories deal with breakdowns in intersensory integration in which hearing loss effects visual development. Bartley (1958) introduced the notion of heteromodal reciprocity in which simultaneous stimulation of one sense while another is being stimulated either raises or lowers the threshold of the first. This facilitates or inhibits neural activity of that sense. Thus loss of auditory function could severely depress visual function at the integrational level due to lack of facilitating connection. Myklebust (1960) supports this concept by stating that visual function may be altered because of lack of intersensory stimulation, implying that certain neural mechanisms associated with vision are dependent on auditory input for proper development. Birch and Belmont (1964) used an auditory-visual pattern matching task with 50 normal and 150 retarded readers aged 9 years to 10-1/2 years. Results indicate that a breakdown in ability to integrate input from both sense modalities greatly increases a child's chance of becoming a poor reader.

Various theoretical viewpoints have been invoked to account for possible visual problems associated with deafness. The most prevalent theories (Piaget, 1952, Brunner, 1964, Hebb, 1949, Delacato, 1959) imply intersensory integration in which perceptual development occurs through mutual development of all the senses. The theories warn that any break in the connections between various senses will have an adverse effect on the development of other senses.

Piaget (1952) proposed that a child progresses through certain developmental stages in which he forms psycho-motor action patterns called schemata. At first these schemata are overt actions. At the child develops, these schemata are changed, new ones formed; and then internalized as abstract operations. Development and modification of schemata is accomplished through the processes of assimilation and accommodation. Assimilation is the process of changing elements in the environment in such a way that they become integrated into the existing structure of the organism in the form of schemata. Accommodation is the modification of schemata which are beneficial to the organism. Through assimilation, the child, as he develops, forms new schemata which, at first, are simple overt motor patterns. Later they become modified and more complex through accommodation. Usually accommodation occurs when the child accidentally performs an action which accomplishes the intended goal more efficiently than the previously used schemata.

This new action pattern is now incorporated in the orginal schemata. Through the aforementioned progression from overt to internalized schemata, what once were overt actions become internalized as abstract concepts as the child develops. Any interruption in the progression will cause developmental retardation in various systems.

Piaget (1952) believes that intersensory connections are vital for development of the intellect which includes all perceptual processes. As for audition and vision, he states:

> Observation shows that very early, perhaps from the very beginnings of orientation in looking, coordinations exist between vision and hearing.... Subsequently, the relationships between vision and prehension, touch kinesthetic impressions, etc. These intersensorial coordinations, this organization of heterogeneous schemata will give the visual images increasingly rich meanings and make assimilation no longer an end in itself but an instrument at the service of vastor assimilations.

Thus, any breakdown in this coordination has an adverse effect on development which may either halt or retard maturation of the visual system depending on when this breakdown occurs.

Brunner (1964) also theorizes intersensory integration. Integration of sensory inputs from differing modalities in his theory is an ontogenetic phenomenon. Cognitive growth in this system follows closely the stages of Piaget's; action, iconic (representative), and symbolic (language). Each modality must follow this progression or there is retardation in development of that modality or system. Audition and vision are integrated modalities in Brunner's theory.

D. O. Hebb (1949) presented a neuropsychological theory of perceptual development. The basic building block of percepts in his theory is the cell assembly. A cell assembly is a group of neurons which have become interconnected through repeated contacts with a certain part of the environment. Once formed, the assembly fires whenever its corresponding element in the environment is contacted. Cell assemblies group together in higher order units with the end result being a particular percept whenever these units fire. Input from all modalities is essential to formation of cell assemblies and higher order units. Any breakdown in input from one or more modalities will inhibit development of higher assemblies and thus result in perceptual retardation.

Another neurological theory is presented by Delacato (1959, 1963). This theory focuses on central brain processes. There is an orderly developmental progression in brain development beginning with the medulla, pons, midbrain, and finally the cortex. Development of one brain area must be complete in order to insure normal development of the next. Any interruption or incomplete development will result in problems of mobility

and/or communication. Thus, impairment of the auditory system will have a detrimental effect on development of one or more sensory systems.

Thus, from the research presented above one can see that:

(1) There appears to be a relationship between hearing loss and deficient visual perception abilities;

(2) Decreased visual perception skills have a positive relationship with poor reading abilities;

(3) Remedial training in perceptual skills can enhance reading abilities;

(4) The theoretical framework proposed to explain these effects involves a breakdown in sensory integration between the visual and auditory sensory mode.

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THE PLACE OF VISUAL PERCEPTION IN PROJECT LIFE

Language is commonly regarded as synonymous with speech. However, it need not be limited to one mode of presentation. Although Sapir (1921) includes the word "sounds" in his definition, by removing this word, the definition changes only by the lack of delimitation of the mode of presentation. Therefore, it is suggested that language be defined as the communication of ideas, emotions and desires by means of voluntarily produced symbols.

Now that language has been defined, the next logical step appears to be language development. Myklebust (1964) cites a hierarchy of language development commencing with inner language - associating experience and symbol - progressing to receptive language - relating symbol to experience - and culminating in expressive language - using symbols to communicate.

The common elements throughout language development are experience and symbol. Experience is a sequence of events which can stop at any level. Barsch (1967) and Myklebust (1964) agree on the sequence of sensation, perception, symbolization, and conceptualization; although, Myklebust also adds a middle level of imagery. Nevertheless, it is evident that symbolization and conceptualization are dependent upon sensation and perception. Merleau - Ponty (1964) puts it this way, ". . . all our experience, all our knowledge, has the same fundamental structures,. . . which we have found in perceptual experience."

The prelingually deaf child, who is unable to progress through the hierarchy of language development aurally, must depend upon a visual symbol system for his language development. Recognizing the deaf child's plight and realizing that the printed word is the greatest resource of visual communication, Mr. Harley Wooden, in 1963, initiated the development of a language project based upon the printed word. (Wooden and Willard, 1965; Wooden, 1966; Pfau, 1968).

After a period of growth and development, Project LIFE (Language Improvement to Facilitate Education) emerged with three basic goals paralleling Myklebust's language development. It is believed that expressive language will exhibit itself spontaneously once receptive language has been assimilated. Therefore, initial emphasis has been placed upon the inner and receptive languages. These are developed by presenting visual experiences (pictures) in association with visual symbols (printed words). This material is on filmstrip in the form of a linear program. It is designed for individualized instruction in conjunction with the Project LIFE Program Master. (Pfau, 1969a; Pfau, 1969b)

Since the Project is using printed material to develop language, it is in fact agreeing with Dr. Arthur Gates (1926) when he mentioned the possibility of teaching language to the deaf through the medium of the printed word. Hence, the visual perceptual factors affecting reading become critical to language development.

Perceptual efficiency appears to be related to success in reading (Coleman, 1953; Bryant, 1964; Wepman, 1967; Shea, 1968); however, perceptual efficiency is developed through perceptual experience (Tinker, 1965; Cleland, 1966). Therefore, one objective in a reading based language program must be perceptual development. [It is important to note at this point that perceptual development is not an isolated process. On the contrary, there is an interdependence of language, perception, and thinking (Piaget, 1952; Harrington, 1964; Robertson, 1967; Frostig, 1968). Hence, perceptual training and thinking activities programs have been incorporated into the entire language package.]

Vision, which accounts for 75% to 80% of a child's learning (Apell, 1957), not to mention its relationship to the printed word, must therefore be the primary area of perceptual training.

Meyerson (1967) believes, "visual perception is the process of giving consistent meaning to that which is observed." Hebb (1949) and others (Smith and Dechant, 1961; Heilman, 1961; Russell and Fea, 1963) have stated that it is a learned process which improves through experience. Furthermore, the major period of perceptual growth occurs between the ages of two and seven years, (Piaget and Inhelder, 1956; Frostig and Horne, 1964). Hence, with evidence indicating detrimental effects or even permanent damage due to early deprivation (Casler, 1961; Ausubel, 1965; Bloom, 1965; Scrimshaw, 1969), it is important to provide training activities for specific visual areas (Diack, 1960; Bryant, 1964; Kinsbourne, 1969) as soon as the child is ready (Robinovitch, 1962; Perrin, 1969).

Literature in the field of reading ability maintains several visual skills which appear to have some relationship with success in reading. These include discriminations of forms or configurations (Benton, 1962; Tinker, 1965; Myklebust and Johnson, 1967, etc.), colors (Betts, 1957; Shearron, 1969), and letters (Wheelock and Silvaroli, 1967; Popp, 1964; Barrett, 1965, etc.); substitutions or deletions (Money, 1962; Vernon, 1957; Bryant, 1964, etc.), spatial orientation (Davidson, 1935; Goins, 1958; Saunders, 1962; etc.), organization (de Hirsch, Jansky, Langford, 1966; Harris, 1959; Doehring, 1968, etc.), figure-ground (Goins, 1958; Frostig and Horne, 1964; Cleland, 1966), visual memory (Bing, 1961; Money, 1962; Clelend, 1966, etc), perceptual speed (Goins, 1958; Johnson and Myklebust, 1967; Doehring, 1968, etc.), motor assistance (Kephart, 1960; Delacato, 1963; Barsch, 1967, etc.), and integration (Wepman, 1962; Koppitz, 1964; Sabatino, 1968, etc.).

The perceptual training materials developed by Project LIFE place heavy emphasis on the skills mentioned. Motor assistance and integration are used due to the nature of the materials and physical response; however, visual memory and perceptual speed were not part of the original package of thirty filmstrips. These will be included at a later time. In fact, memory is one of the unit designations in the Project's thinking activity series.

Summary

This paper has attempted to show how visual perception can be an important part of a language program. Language was defined as communication by means of voluntarily produced symbols. It was then pointed out that there are three developmental levels of language beginning with inner language, progressing to receptive language, and culminating in expressive language. It was suggested that language can be developed by the medium of the printed word. Also, visual perception is related to reading success and must be developed early. Specific visual skills were enumerated and mentioned as part of a training program within the entire language package.

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ANALYSIS OF THE PERFORMANCE OF DEAF CHILDREN ON THE LIFE PERCEPTUAL TRAINING FILMSTRIPS

Procedure

The unit outline, contents by section and unit as expressed in Purposes and Behavioral Objectives and representative frames from the filmstrips are found in Appendixes A, B, and C of the report. The rationale and background of the materials was presented in the previous two chapters.

During the academic year 1970-71 the visual perceptual materials were utilized by more than 350 hearing-impaired children in the 102 field test classes. These classes represented all facets of educational procedures (day, residential, private, public). Each school was asked to keep error rate records (Appendix D) on each child using the materials and if possible, frame-by-frame record of the children's responses. The data from the field test schools was combined for all educational procedures and separated according to filmstrip identification and student's ages.

Results

The data received on hearing-impaired children who ranged in age from three(3) years to thirteen (13) years was tabulated according to age and filmstrip. The number of students on which the data was tabulated, the mean number of errors, the standard deviation of errors and the range of errors for each filmstrip is found in table 1 (a – d). This data represents the first normative data on the LIFE Perceptual filmstrips.

The percentage of 6 year old children making specific number of errors and the cumulative percentages by units and sections is found in tables 2 through 8. The same data for error rates of 0-10 errors is graphically presented in figures 1 - 8.

Revisions and GE/LIFE Identification

Revisions were made on the visual perception filmstrips prior to their release to the General Electric Company for marketing distribution. The listing of the revisions are found in Appendix E. These revisions were made on the basis of the frame-by-frame analysis from the field, written comments by teachers, a research conference for the purpose of evaluating the materials (teachers from the Metropolitan Washington area whose children were using the LIFE materials) and recommendations by consultants.

Based on the recommendations of consultants and staff personnel, and the field test data the Visual-Perceptual materials were resequenced for distribution by General Electric Company. The resequence (GE/LIFE filmstrip I. D.)with the comparison

to the LIFE field test I. D. is found in Appendix F.

Teacher's Comments

The comments from the field are too numerous to list. Negative comments were basically related to equipment problems and length of some of the filmstrips. The positive comments related to increases in behavior of children in reading skills, attention span, initiative, independent skills and carry-over of skills to other classroom activities.

Conclusion

The total impact of the perceptual materials on the child is yet to be measured. It is sound in theory and principle, but measurable implications are not yet available. Special research studies of short-term duration and long-range longitudinal investigation should help in answering the questions related to "The total impact of the LIFE visual perceptual materials."

Table 1 (a) Number of students, mean error rate, standard deviation of the error rate and range of errors by age of hearing-impaired students for the Project LIFE Perceptual Training filmstrips.

FILMSTRIP		AGE 3	4	5	6	7	8	9	10	11	12	13
A-1	N*	2	5	37	148	17	15	12	4	8	1	3
	X	22.0	7.6	6.7	5.6	6.2	5.6	5.3	5.8	1.4	0.0	2.0
	S.D.	2.8	8.3	13.2	9.4	8.2	8.9	9.9	9.0	6.3	0.0	1.7
	Range	20-24	0-20	0-51	0-48	0-25	0-22	0-28	0-19	0-7	-	0-3
A-2	N	2	5	31	132	13	22	18	3	5	1	3
	X	19.0	14.6	6.3	7.4	3.2	5.7	4.3	1.7	1.4	6.0	1.7
	S.D.	0.0	16.1	11.1	11.3	3.3	8.9	6.2	0.6	1.1	0.0	1.5
	Range	19-19	1-40	0-44	0-58	0-11	0-37	0-21	1-2	0-3	-	0-3
B-1	N	2	5	36	151	19	16	9	4	9	1	3
	X	5.0	6.2	4.9	4.5	4.3	4.5	0.6	0.5	0.6	2.0	0.0
	S.D.	7.1	7.1	10.7	7.4	7.3	13.3	1.1	0.6	0.5	0.0	0.0
	Range	0-10	1-17	0-59	0-33	0-30	0-54	0-3	0-1	0-1	-	-
B-2	N	2	5	35	139	16	19	14	4	5	1	1
	X	12.5	10.8	7.6	7.2	4.8	3.7	4.9	4.7	2.4	1.0	3.0
	S.D.	13.4	11.7	10.7	15.3	6.8	3.3	5.7	3.4	4.3	0.0	0.0
	Range	3-22	3-30	0-45	0-72	0-27	0-11	0-17	0-8	0-10	-	-
B-3 (Test)	N	-	2	20	86	15	21	14	2	5	-	1
	X	-	30.5	10.9	11.7	8.0	8.1	7.2	1.0	2.6	-	5.0
	S.D.	-	37.5	10.6	14.1	7.7	11.3	8.1	0.0	4.2	-	0.0
	Range	-	4-57	1-44	0-69	0-27	0-52	0-30	1-1	0-10	-	-
IA-1	N	1	5	39	156	22	24	19	6	9	2	2
	X	24.0	8.2	8.3	9.0	4.1	9.8	7.4	5.8	2.0	5.0	12.0
	S.D.	0.0	8.1	9.9	15.7	4.2	16.3	14.9	10.6	4.5	5.7	0.0
	Range	-	1-20	0-42	0-92	0-16	0-64	0-29	0-8	0-9	3-4	11-18
IA-2	N	1	4	36	152	21	24	18	7	9	2	2
	X	19.0	6.8	5.7	7.9	4.9	6.7	6.1	2.1	2.2	3.5	14.5
	S.D.	0.0	8.3	8.9	12.6	4.5	13.8	7.3	7.1	2.9	0.7	4.9
	Range	-	1-19	0-43	0-75	0-16	0-64	0-29	0-8	0-9	3-4	11-18
IA-3	N	1	4	36	152	21	24	18	7	9	2	2
	X	4.0	5.0	6.6	6.7	4.8	3.3	5.3	3.4	2.7	4.0	17.0
	S.D.	0.0	4.2	8.4	8.2	5.9	3.7	8.3	3.8	3.3	2.8	9.9
	Range	-	3-9	0-34	0-65	0-23	0-13	0-27	0-10	0-11	2-6	10-24

*NOTE: Unequal N's due to students not completing all filmstrips.

Table I (b) continued

FILMSTRIP		AGE 3	4	5	6	7	8	9	10	11	12	13
IA-4	N*	1	4	34	145	20	22	16	6	9	2	1
	X	5.0	6.3	7.8	6.6	8.2	5.6	7.9	6.3	4.0	3.0	6.0
	S.D.	0.0	2.8	8.7	8.2	6.8	4.9	8.3	6.9	3.3	2.8	0.0
	Range	-	3-9	0-28	0-45	0-20	0-22	0-24	0-15	0-9	1-5	-
IB-1	N	2	5	38	141	17	26	15	7	10	2	1
	X	8.5	7.8	6.4	5.5	3.6	5.3	7.0	1.1	1.9	1.5	2.0
	S.D.	4.9	7.6	9.9	9.3	4.7	10.3	11.2	1.5	2.5	0.7	0.0
	Range	5-12	1-20	0-60	0-42	0-18	1-50	0-41	0-4	0-8	1-2	-
IB-2	N	2	5	34	135	17	24	10	6	10	2	1
	X	14.5	12.4	8.3	7.1	6.8	3.5	4.1	2.3	2.3	4.0	2.0
	S.D.	12.0	16.8	11.3	10.5	7.1	3.2	4.9	2.3	2.4	1.4	0.0
	Range	6-23	3-41	0-62	0-62	0-27	0-10	0-15	0-5	0-7	3-5	-
IB-3	N	1	5	34	131	17	24	13	6	9	1	1
	X	6.0	9.0	4.9	6.6	7.1	3.5	1.7	1.2	2.4	2.0	0.0
	S.D.	0.0	12.8	4.2	10.4	12.7	5.0	2.4	1.8	1.9	0.0	0.0
	Range	-	1-29	0-18	0-63	0-52	0-21	0-9	0-4	0-5	-	-
IIA-1	N	1	4	29	124	18	22	15	8	9	2	1
	X	7.0	2.8	4.7	5.1	4.9	3.8	5.0	4.3	1.9	0.5	23.0
	S.D.	0.0	3.6	4.2	10.4	10.1	6.2	7.2	9.3	2.4	0.7	0.0
	Range	-	1-8	0-12	0-60	0-43	0-21	0-21	0-27	0-7	0-1	-
IIA-2	N	1	4	29	119	16	18	11	7	9	2	1
	X	8.0	7.0	7.4	7.1	8.9	6.7	10.8	5.3	5.7	1.5	20.0
	S.D.	0.0	4.3	6.1	7.5	9.2	5.4	9.0	3.8	6.9	0.7	0.0
	Range	-	1-11	0-27	0-47	1-39	1-21	1-27	0-10	1-23	1-2	-
IIB-1	N	1	4	27	117	15	22	12	6	9	2	1
	X	11.0	8.5	8.4	10.2	8.1	6.5	13.5	5.7	5.3	1.5	4.0
	S.D.	0.0	6.6	6.7	12.2	8.1	3.4	14.7	5.3	4.8	0.7	0.0
	Range	-	2-16	0-23	0-53	0-25	0-15	1-50	0-12	0-14	1-2	-
IIB-2	N	-	3	26	107	16	22	13	6	9	2	1
	X	-	10.7	8.7	8.5	8.4	6.0	6.1	4.7	5.2	1.5	4.0
	S.D.	-	10.6	7.4	8.4	6.3	5.5	7.7	4.5	3.7	0.7	0.0
	Range	-	1-22	1-25	0-48	0-19	1-26	0-28	0-10	0-13	1-2	-

*NOTE: Unequal N's due to students not completing all filmstrips.

Table I (c) continued

FILMSTRIP		AGE 3	4	5	6	7	8	9	10	11	12	13
IIIA-1	N*	-	3	24	100	12	13	10	6	8	2	1
	X	-	6.7	5.3	7.0	5.5	8.4	• 8.0	3.8	4.9	2.0	1.0
	S.D.	-	4.2	5.1	10.2	8.1	12.1	7.6	3.7	4.5	0.0	0.0
	Range	-	2-10	1-19	0-57	0-30	0-41	0-27	1-10	0-14	2-2	-
IIIA-2	N	-	3	22	95	10	10	10	4	9	2	1
	X	-	4.7	7.8	8.4	8.1	6.3	13.9	6.3	4.2	3.0	4.0
	S.D.	-	5.5	7.6	9.9	14.3	6.2	15.2	4.8	3.4	1.4	0.0
	Range	-	1-11	0-31	0-58	0-48	1-22	2-53	2-13	0-9	2-4	-
IIIB-1	N	-	3	21	95	12	16	6	4	9	2	1
	X	-	10.7	5.6	6.2	6.9	6.4	7.7	7.3	3.9	5.0	3.0
	S.D.	-	10.9	3.5	5.4	6.7	6.7	6.1	5.2	3.2	1.4	0.0
	Range	-	2-23	1-10	0-32	0-20	0-27	2-16	1-12	0-11	4-6	-
IVA-1	N	-	2	15	84	7	11	11	3	8	2	1
	X	-	4.0	5.4	7.1	3.4	6.8	11.5	9.0	4.6	4.5	2.0
	S.D.	-	5.7	4.1	6.3	3.1	6.1	7.3	10.2	4.1	4.9	0.0
	Range	-	0-8	1-14	0-33	0-8	1-21	0-21	0-20	0-11	1-8	-
IVA-2	N	-	2	15	74	7	9	9	3	7	1	1
	X	-	3.5	3.3	6.2	6.3	7.1	8.3	4.7	4.7	3.0	2.0
	S.D.	-	4.9	2.5	5.4	10.3	7.6	7.6	7.2	4.8	0.0	0.0
	Range	-	0-7	0-9	0-29	0-29	0-21	0-21	0-13	1-14	-	-
IVB-1	N	-	1	15	82	9	8	7	3	8	1	1
	X	-	7.0	5.9	8.5	6.3	4.1	7.0	3.0	3.6	2.0	3.0
	S.D.	-	0.0	3.4	10.3	7.1	3.0	5.4	3.0	2.1	0.0	0.0
	Range	-	-	2-13	0-65	1-20	1-8	0-17	0-6	2-7	-	-
VB-1	N	-	1	13	75	9	7	7	3	7	1	1
	X	-	2.0	2.7	3.2	3.1	1.4	1.3	1.0	1.4	2.0	4.0
	S.D.	-	0.0	2.8	3.7	2.2	1.4	1.6	1.0	0.9	0.0	0.0
	Range	-	-	0-8	0-20	0-6	0-4	0-4	0-2	0-3	-	-
VB-2	N	-	1	14	72	9	6	7	3	7	1	1
	X	-	1.0	4.1	2.8	2.8	3.0	3.1	1.0	1.4	0.0	4.0
	S.D.	-	0.0	4.2	3.2	2.5	3.3	2.8	1.7	1.6	0.0	0.0
	Range	-	-	0-15	0-14	0-7	0-7	0-7	0-3	0-4	-	-

*NOTE: Unequal N's due to students not completing all filmstrips.

Table I (d) continued

FILMSTRIP		AGE 3	4	5	6	7	8	9	10	11	12	13
VB-3	N*	-	1	12	97	8	6	7	3	7	1	1
	X	-	1.0	2.8	2.5	2.3	1.2	3.3	1.3	2.0	1.0	5.0
	S.D.	-	0.0	3.7	4.7	2.3	0.9	3.3	2.3	2.6	0.0	0.0
	Range	-	-	0-10	0-29	0-7	0-2	0-8	0-4	0-7	-	-
VB-4	N	-	2	13	64	8	7	6	3	7	1	1
	X	-	3.0	3.6	4.4	2.8	3.1	4.8	1.7	2.3	1.0	4.0
	S.D.	-	0.0	3.1	5.5	1.8	4.1	2.6	2.1	1.4	0.0	0.0
	Range	-	3-3	0-10	0-36	1-6	0-9	2-9	0-4	1-4	-	-
VIA-1	N	-	3	13	60	7	8	9	3	7	1	1
	X	-	2.3	5.8	3.6	1.3	2.4	4.2	4.3	1.4	2.0	0.0
	S.D.	-	3.2	10.4	4.5	1.6	3.7	3.0	5.9	1.6	0.0	0.0
	Range	-	1-6	0-39	0-28	0-4	0-11	1-9	0-11	0-4	-	-
VIA-2	N	-	3	13	55	7	9	7	3	7	1	1
	X	-	0.7	5.4	3.8	1.9	4.3	5.7	1.3	1.4	2.0	0.0
	S.D.	-	0.6	4.8	3.3	2.1	4.4	3.4	2.3	1.5	0.0	0.0
	Range	-	0-1	0-17	0-10	0-5	0-14	1-10	0-4	0-4	-	-
VIB-1	N	-	2	13	58	8	7	6	3	7	1	1
	X	-	0.5	4.1	3.4	4.0	1.0	4.3	1.0	0.9	0.0	0.0
	S.D.	-	0.7	3.8	4.2	4.2	0.8	2.7	1.7	1.1	0.0	0.0
	Range	-	0-1	0-10	0-18	0-12	0-2	1-8	0-3	0-2	-	-
VIB-2	N	-	2	11	48	8	7	6	3	7	1	1
	X	-	7.0	5.9	4.3	4.6	3.0	6.7	1.0	2.4	2.0	0.0
	S.D.	-	5.7	4.5	4.7	3.6	2.8	4.2	1.7	2.9	0.0	0.0
	Range	-	3-11	0-15	0-19	0-10	1-9	3-14	0-3	0-8	-	-

*NOTE: Unequal N's due to students not completing all filmstrips.

Table 2. Error rates in percentages for six (6) year old hearing-impaired students on the Project LIFE Visual Perceptual Programs.

INTRODUCTORY UNITS

Program [1]	A1			A2			B1			B2			B3 (test)		
Errors [2]	N[3]	P[4]	PR[5]	N	P	PR	N	P	PR	N	P	PR	N	P	PR
0	45	30.4	30.4	30	23.2	23.2	57	39.0	39.0	18	13.3	13.3	4	4.9	4.9
1	24	16.2	46.6	24	18.6	41.8	21	14.3	53.3	26	19.2	32.9	7	8.6	13.5
2	26	17.6	64.2	19	14.7	56.5	23	15.7	69.0	20	14.8	47.3	6	7.4	20.9
3	2	1.4	65.6	8	6.2	62.7	12	8.2	77.2	15	11.1	58.4	10	12.3	33.2
4	4	2.7	68.3	4	3.1	65.8	2	1.3	78.5	12	8.8	67.2	5	6.1	39.3
5	7	4.7	73.0	4	3.1	68.9	0	0.0	78.5	3	2.2	69.4	3	3.7	43.0
6	2	1.4	74.4	6	4.6	73.5	2	1.3	79.8	9	6.6	76.0	3	3.7	46.7
7	4	2.7	77.1	1	0.7	74.2	1	0.6	80.4	2	1.4	77.4	3	3.7	50.4
8	2	1.4	78.5	1	0.7	74.9	2	1.3	81.7	2	1.4	78.8	1	1.2	51.6
9	2	1.4	79.9	1	0.7	75.6	2	1.3	83.0	2	1.4	80.2	3	3.7	55.3
10-19	15	10.1	90.0	18	14.0	89.6	14	9.5	92.5	12	8.8	89.0	21	25.9	81.2
20-29	9	6.1	96.1	6	4.6	94.2	9	6.1	98.6	7	5.1	94.1	8	9.8	91.0
30-39	3	2.0	98.1	3	2.3	96.5	1	0.6	99.2	2	1.4	95.5	3	3.7	94.7
40+	3	2.0	100.1	4	3.1	99.6	0	0.0	99.2	5	3.7	99.2	4	4.9	99.6
Total No. of Students	148			129			146			135			81		

1 The programs are identified by the numbering system used for field testing.
2 Errors refer to total errors a student makes on a program.
3 N=the number of students who made the indicated number of errors listed for a program.
4 P=the percentage of the students who made the number of errors listed for a program.
5 PR=accumulative percentage of students who made errors according to the indicated levels on the programs.

Table 3. Error rates in percentages for six (6) year old hearing-impaired students on the Project LIFE Visual Perceptual Programs.

VISUAL PROPERTIES

Program [1]	1A1			1A2			1A3			1A4			1B1			1B2			1B3		
Errors [2]	N[3]	P[4]	PR[5]	N	P	PR	N	P	PR	N	P	PR	N	P	PR	N	P	PR	N	P	PR
0	14	9.3	9.3	15	10.4	10.4	9	6.4	6.4	19	13.6	13.6	22	16.5	16.5	14	10.6	10.6	14	10.9	10.9
1	28	18.7	28.0	19	13.2	23.6	19	13.5	19.9	20	14.3	27.9	27	20.3	36.8	28	18.3	28.9	25	19.5	30.4
2	19	12.7	40.7	25	17.4	41.0	19	13.5	33.4	18	12.9	40.8	13	9.7	46.5	8	6.1	35.0	18	14.0	44.4
3	16	10.7	51.4	11	7.6	48.6	15	10.7	44.1	10	7.1	47.9	18	13.5	60.0	23	17.5	52.5	13	10.1	54.5
4	15	10.0	61.4	12	8.3	56.9	9	6.4	50.5	8	5.7	53.6	18	6.0	66.0	10	7.6	60.1	12	9.3	63.8
5	12	8.0	69.4	5	3.4	60.3	9	6.4	56.9	9	6.4	60.0	14	10.5	76.5	9	6.8	66.9	10	7.8	71.6
6	5	3.3	72.7	13	9.0	69.3	9	6.4	63.3	7	5.0	65.0	6	4.5	81.0	3	2.2	69.1	5	3.9	75.5
7	0	0.0	72.7	4	2.7	72.0	9	6.4	69.7	7	5.0	70.0	2	1.6	82.5	7	5.3	74.4	5	3.9	79.4
8	4	2.6	75.3	8	5.5	77.5	7	5.0	74.7	5	3.5	73.5	5	3.7	86.2	3	2.2	76.6	5	3.9	83.3
9	6	4.0	79.3	3	2.0	79.5	4	2.8	77.5	2	1.4	74.9	2	1.5	87.7	2	1.5	78.1	3	2.3	85.6
10-19	11	7.3	86.6	17	11.8	91.3	23	16.4	93.9	27	19.4	94.3	9	6.7	94.4	18	13.7	91.8	5	3.9	89.5
20-29	7	4.6	91.2	4	2.7	94.0	6	4.2	98.1	4	2.8	97.1	3	2.2	96.4	2	1.5	93.3	6	4.6	94.1
30-39	4	2.6	93.8	1	0.6	94.6	1	0.7	98.8	2	1.4	98.5	2	1.5	98.1	3	2.2	95.5	4	3.1	97.2
40+	9	6.0	99.8	6	4.1	98.7	1	0.7	99.5	1	0.7	99.2	2	1.5	99.6	5	3.8	99.3	3	2.3	99.5
Total No. of Students	150			143			140			139			131			131			128		

[1] The programs are identified by the numbering system used for field testing.
[2] Errors refer to total errors a student makes on a program.
[3] N=the number of students who made the indicated number of errors listed for a program.
[4] P=the percentage of the students who made the number of errors listed for a program.
[5] PR=accumulative percentage of students who made errors according to the indicated levels on the programs.

Table 4. Error rates in percentages for six (6) year old hearing-impaired students on the Project LIFE Visual Perceptual Programs.

ADDITIONS - OMISSIONS

Program [1]	IIA1			IIA2			IIB1			IIB2		
Errors [2]	N[3]	P[4]	PR[5]	N	P	PR	N	P	PR	N	P	PR
0	30	24.3	24.3	12	12.3	10.3	2	1.7	1.7	3	2.9	2.9
1	24	19.5	43.8	6	5.1	15.4	7	6.1	7.8	7	6.8	9.7
2	20	16.2	60.0	12	10.3	25.7	9	7.9	15.7	1	0.9	10.6
3	9	7.3	67.3	13	11.2	36.9	10	8.8	24.5	19	18.6	29.2
4	8	6.5	73.8	12	10.3	47.2	8	7.0	31.5	10	9.8	39.0
5	5	4.0	77.8	5	4.3	51.5	6	5.3	36.8	10	9.8	48.8
6	3	2.4	80.2	9	7.7	59.2	7	6.1	42.9	6	5.8	54.6
7	6	4.8	85.0	7	6.0	65.2	4	3.5	46.4	5	4.9	59.5
8	6	4.8	89.8	4	3.4	68.6	13	11.5	57.9	5	4.9	64.4
9	2	1.6	91.4	8	6.8	75.4	8	7.0	64.9	10	9.8	74.2
10-19	5	4.0	95.4	21	18.1	93.5	31	27.4	92.3	17	16.6	90.8
20-29	0	0.0	95.4	5	4.3	97.8	4	3.5	95.8	7	6.8	97.6
30-39	0	0.0	95.4	0	0.0	97.8	1	0.8	96.6	0	0.0	97.6
40+	5	4.0	99.4	2	1.7	99.5	3	2.6	99.2	2	1.9	99.5
Total No. of Students	123			116			113			102		

1 The programs are identified by the numbering system used for field testing.
2 Errors refer to total errors a student makes on a program.
3 N=the number of students who made the idicated number of errors listed for a program.
4 P=the percentage of the students who made the number of errors listed for a program.
5 PR=accumulative percentage of students who made errors according to the indicated levels on the programs.

Table 5. Error rates in percentages for six (6) year old hearing-impaired students on the Project LIFE Visual Perceptual Programs.

SUPPLEMENTARY												
Program [1]	VIA1			VIA2			VIB1			VIB2		
Errors [2]	N[3]	P[4]	PR[5]	N	P	PR	N	P	PR	N	P	PR
0	16	26.6	26.6	6	10.9	10.9	11	20.0	20.0	9	18.3	18.3
1	6	10.0	36.6	14	25.4	36.3	15	27.2	47.2	14	28.5	46.8
2	9	15.0	51.6	5	9.0	45.3	6	10.9	58.1	2	4.0	50.8
3	6	10.0	61.6	6	10.9	56.2	6	10.9	69.0	4	8.1	58.9
4	6	10.0	71.6	7	12.7	68.9	9	16.3	85.3	3	6.1	65.0
5	5	8.3	79.9	2	3.6	72.5	0	0.0	85.3	3	6.1	71.1
6	1	1.6	81.5	2	3.6	76.1	0	0.0	85.3	3	6.1	77.2
7	1	1.6	83.1	3	5.4	81.5	0	0.0	85.3	2	4.0	81.2
8	4	6.6	89.7	1	1.8	83.3	2	3.6	88.9	2	4.0	85.2
9	2	3.3	93.0	4	7.2	90.5	1	1.8	90.7	1	2.0	87.2
10-19	3	5.0	98.0	5	9.0	99.5	5	9.0	99.7	6	12.2	99.4
20-29	1	1.6	99.6	0	0.0	99.5	0	0.0	99.7	0	0.0	99.4
30-39	0	0.0	99.6	0	0.0	99.5	0	0.0	99.7	0	0.0	99.4
40+	0	0.0	99.6	0	0.0	99.5	0	0.0	99.7	0	0.0	99.4
Total No. of Students	60			55			55			49		

1 The programs are identified by the numbering system used for field testing.
2 Errors refer to total errors a student makes on a program.
3 N=the number of students who made the indicated number of errors listed for a program.
4 P=the percentage of the students who made the number of errors listed for a program.
5 PR=accumulative percentage of students who made errors according to the indicated levels on the programs.

Table 6. Error rates in percentages for six (6) year old hearing-impaired students on the Project LIFE Visual Perceptual Programs.

POSITIONS IN SPACE									
Program [1]	IIIA1			IIIA2			IIIB1		
Errors [2]	N[3]	P[4]	PR[5]	N	P	PR	N	P	PR
0	12	12.3	12.3	11	11.8	11.8	1	1.0	1.0
1	13	13.4	25.7	4	4.3	16.1	9	9.6	10.6
2	10	10.3	36.0	9	9.6	25.7	12	12.9	23.5
3	13	13.4	49.4	10	10.7	36.4	15	16.1	39.6
4	10	10.3	59.7	6	6.4	42.8	5	5.3	44.9
5	5	5.1	64.8	6	6.4	49.2	12	12.9	57.8
6	3	3.0	67.8	7	7.5	56.7	5	5.3	63.1
7	2	2.0	69.8	2	2.1	58.8	6	6.4	69.5
8	4	4.1	73.9	8	8.6	67.4	5	5.3	74.8
9	6	6.1	80.0	4	4.3	71.7	4	4.3	79.1
10-19	12	12.3	92.3	15	16.1	87.8	15	16.1	95.2
20-29	3	3.0	95.3	7	7.5	95.3	3	3.2	98.4
30-39	1	1.0	96.3	1	1.0	96.3	1	1.0	99.4
40+	3	3.0	99.3	3	3.2	99.5	0	0.0	99.4
Total No. of Students	97			93			93		

1 The programs are identified by the numbering system used for field testing.
2 Errors refer to total errors a student makes on a program.
3 N=the number of students who made the indicated number of errors listed for a program.
4 P=the percentage of the students who made the number of errors listed for a program.
5 PR=accumulative percentage of students who made errors according to the indicated levels on the programs.

Table 7. Error rates in percentages for six (6) year old hearing-impaired students on the Project LIFE Visual Perceptual Programs.

FIGURE - GROUND

Program [1]	VB1			VB2			VB3			VB4		
Errors [2]	N [3]	P [4]	PR [5]	N	P	PR	N	P	PR	N	P	PR
0	17	22.9	22.9	22	31.8	31.8	19	27.9	27.9	11	17.4	17.4
1	11	14.8	37.7	8	11.5	43.3	13	19.1	47.0	10	15.8	33.2
2	12	16.2	53.9	14	20.2	63.5	5	7.3	54.3	6	9.5	42.7
3	11	14.8	68.7	7	10.1	73.6	6	8.8	63.1	7	11.1	53.8
4	5	6.7	75.4	5	7.2	80.8	8	11.7	74.8	11	17.4	71.2
5	3	4.0	79.4	4	5.7	86.5	5	7.3	82.1	3	4.7	75.9
6	4	5.4	84.8	3	4.3	90.8	6	8.8	90.9	3	4.7	80.6
7	5	6.7	91.5	0	0.0	90.8	0	0.0	90.9	2	3.1	83.7
8	1	1.3	92.8	1	1.4	92.2	2	2.9	93.8	1	1.5	85.2
9	1	1.3	94.1	1	1.4	93.6	2	2.9	96.7	0	0.0	85.2
10-19	2	4.0	98.1	4	5.7	99.3	0	0.0	96.7	8	12.6	97.8
20-29	1	1.3	99.4	0	0.0	99.3	0	0.0	96.7	0	0.0	97.8
30-39	0	0.0	99.4	0	0.0	99.3	0	0.0	96.7	1	1.5	99.3
40+	0	0.0	99.4	0	0.0	99.3	2	2.9	99.6	0	0.0	99.3
Total No. of Students	74			69			68			63		

1 The programs are identified by the numbering system used for field testing.
2 Errors refer to total errors a student makes on a program.
3 N=the number of students who made the indicated number of errors listed for a program.
4 P=the percentage of the students who made the number of errors listed for a program.
5 PR=accumulative percentage of students who made errors according to the indicated levels on the programs.

Table 8. Error rates in percentages for six (6) year old hearing-impaired students on the Project LIFE Visual Perceptual Programs.

SPATIAL RELATIONSHIPS

Program [1]	IVA1			IVA2			IVB1		
Errors [2]	N[3]	P[4]	PR[5]	N	P	PR	N	P	PR
0	1	1.1	1.1	7	9.2	9.2	3	3.4	3.4
1	9	10.7	11.8	6	7.8	17.0	5	5.7	9.1
2	12	14.2	26.2	5	6.5	23.5	5	5.7	14.8
3	6	7.1	33.1	11	14.4	37.9	15	17.2	32.0
4	10	11.9	45.0	6	7.8	45.7	10	11.4	43.4
5	5	5.9	50.9	10	13.1	58.8	7	8.0	51.4
6	7	8.3	59.2	3	3.9	62.7	6	6.8	58.2
7	3	3.5	62.7	9	11.8	74.5	2	2.2	60.4
8	5	5.9	68.6	3	3.9	78.4	3	3.4	63.8
9	1	1.1	69.7	6	7.8	86.2	6	6.8	70.6
10-19	20	23.8	93.5	7	9.2	95.4	15	17.2	87.8
20-29	3	3.5	97.0	3	3.9	99.3	7	8.0	95.8
30-39	2	2.3	99.3	0	0/0	99.3	2	2.2	98.0
40+	0	0.0	99.3	0	0.0	99.3	1	1.1	99.1
Total No. of Students	84			76			87		

1 The programs are identified by the numbering system used for field testing.
2 Errors refer to total errors a student makes on a program.
3 N=the number of students who made the indicated number of errors listed for a program.
4 P=the percentage of the students who made the number of errors listed for a program.
5 PR=accumulative percentage of students who made errors according to the indicated levels on the programs.

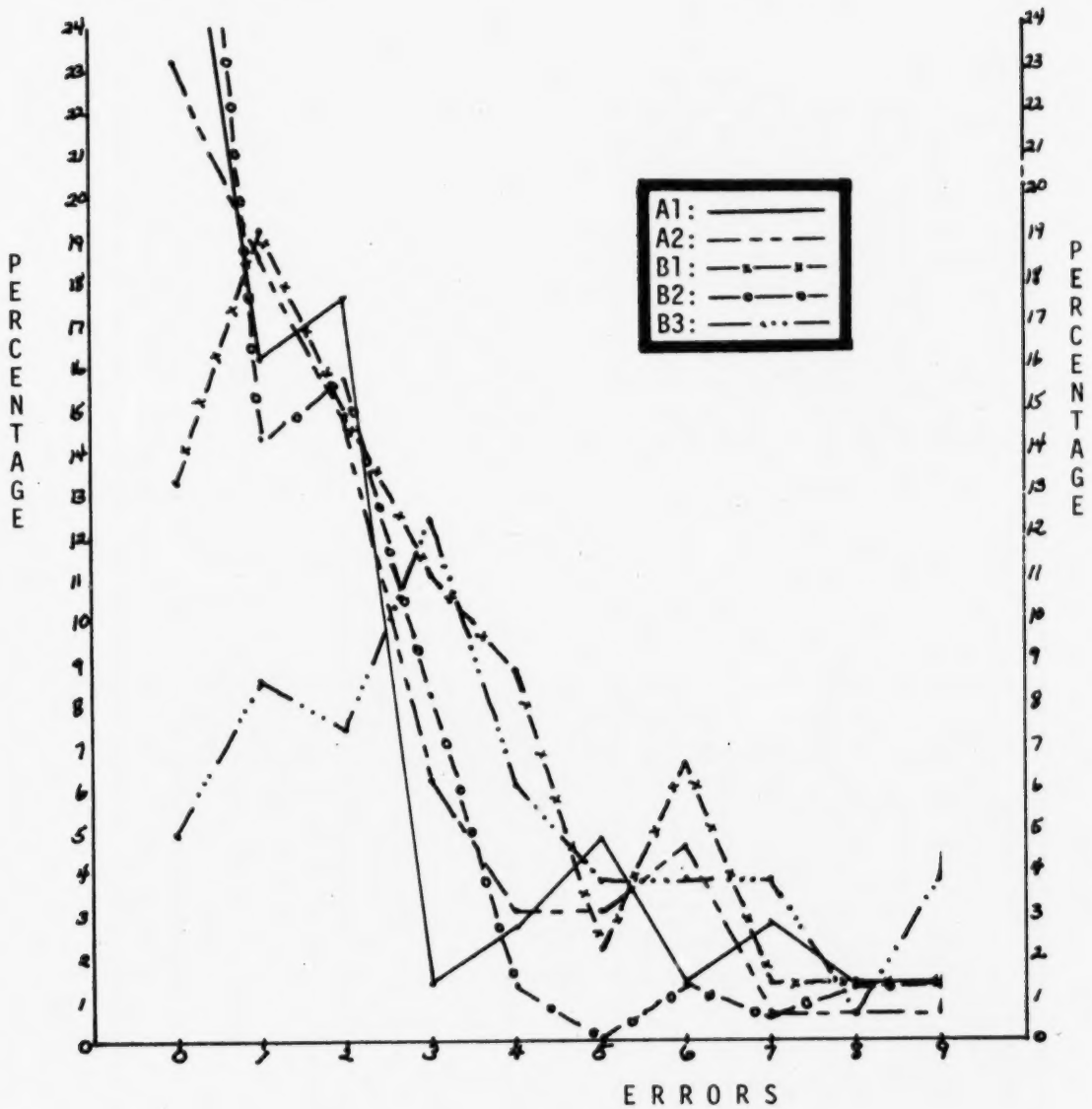

FIG. 1 Percentage errors for Introductory Filmstrips for 6 year old hearing-impaired children

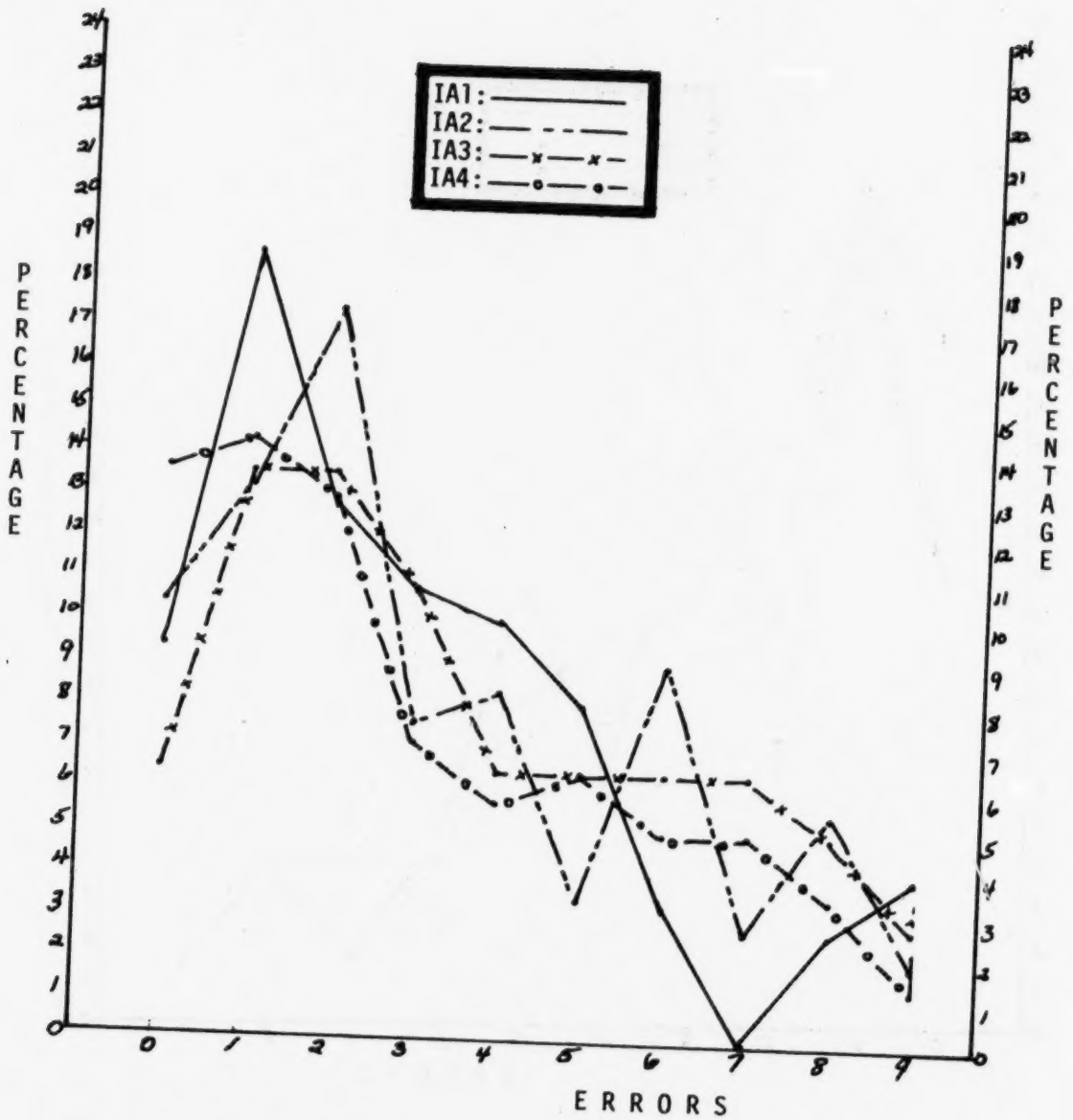

FIG. 2 Percentage errors for Visual Properties Filmstrips for 6 year old hearing-impaired children

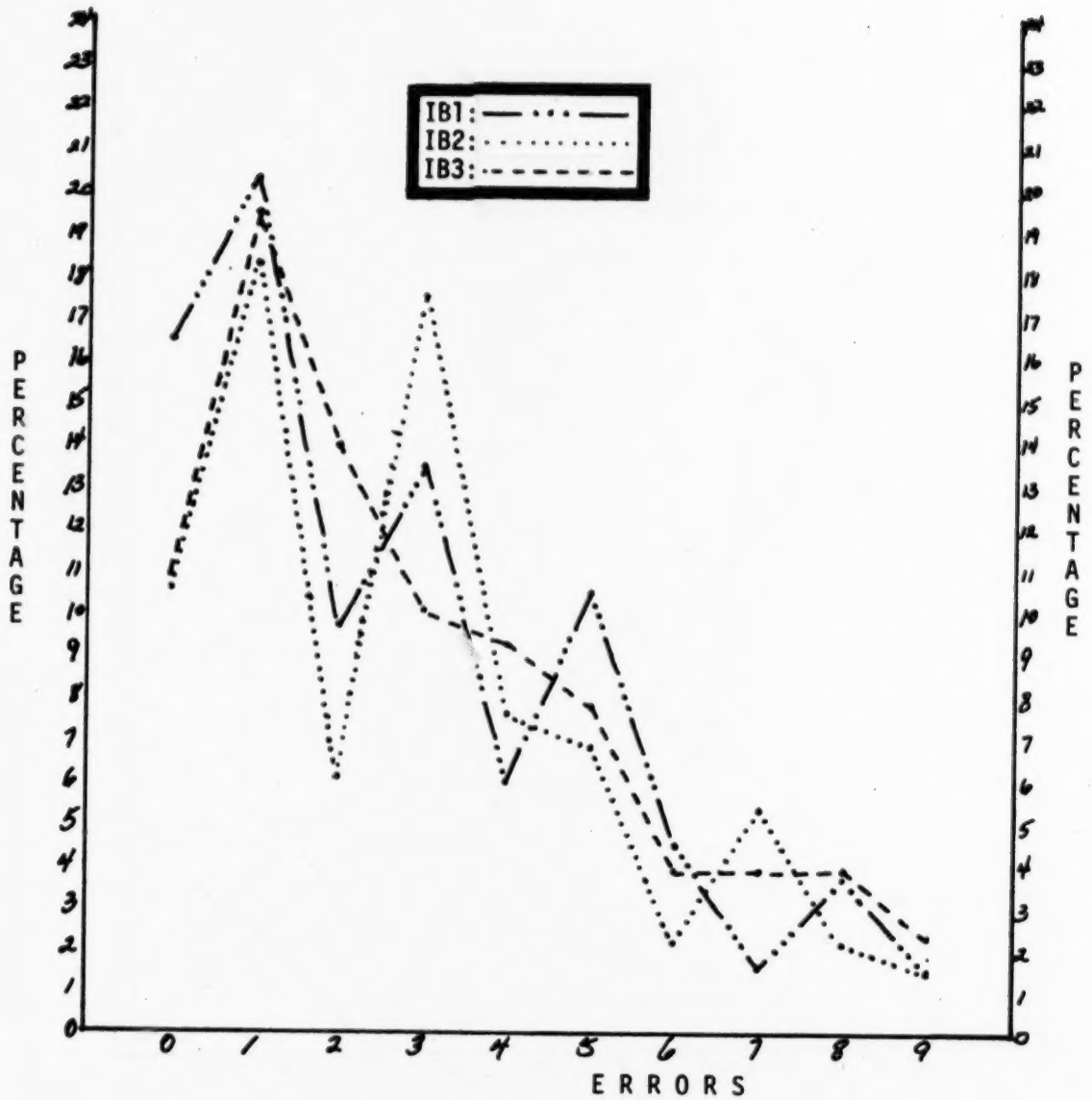

FIG. 3 Percentage errors for Visual Properties Filmstrips for 6 year old hearing impaired children

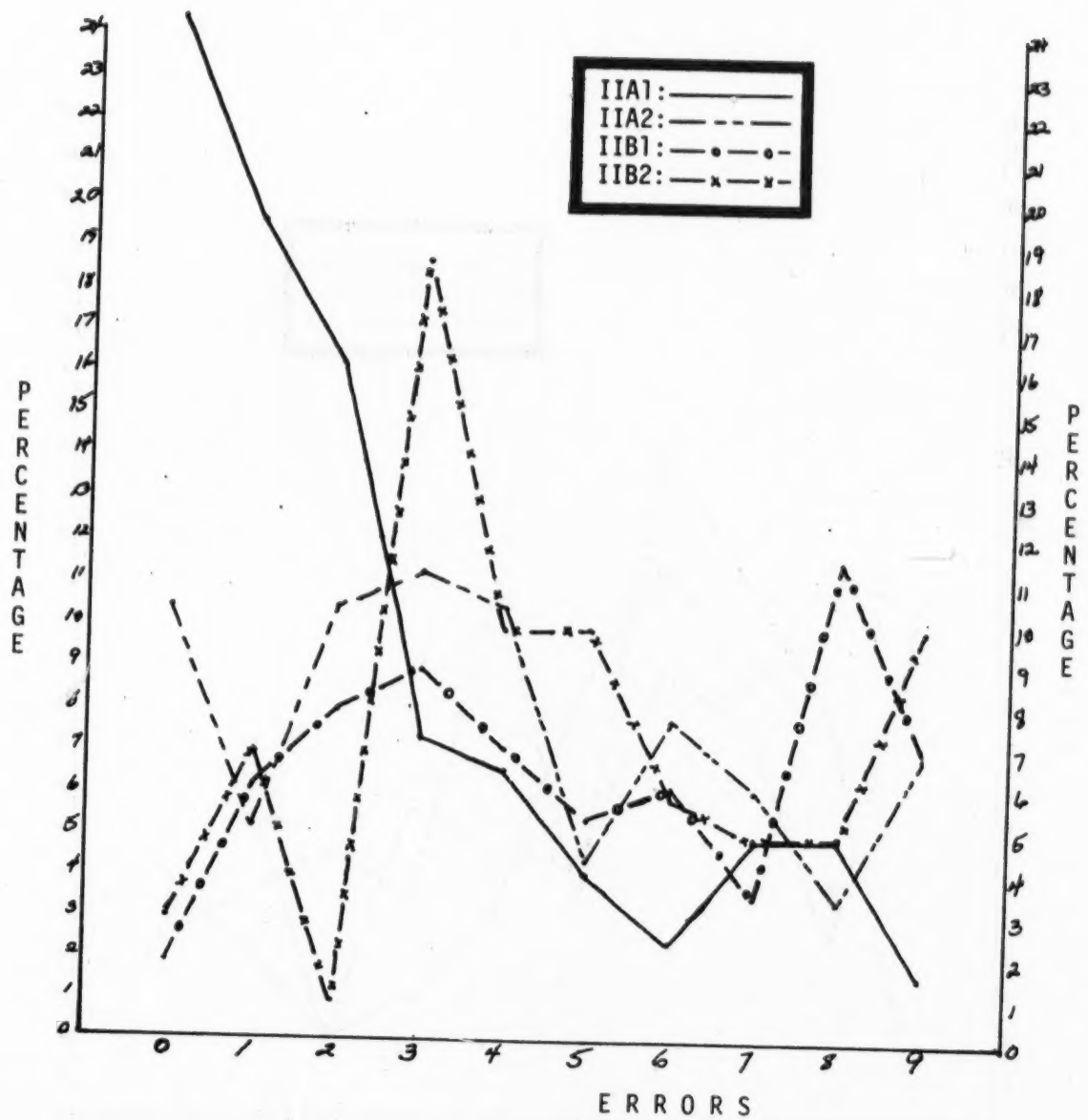

FIG. 4 Percentage errors for Additions-Ommissions Filmstrips for 6 year old hearing impaired children

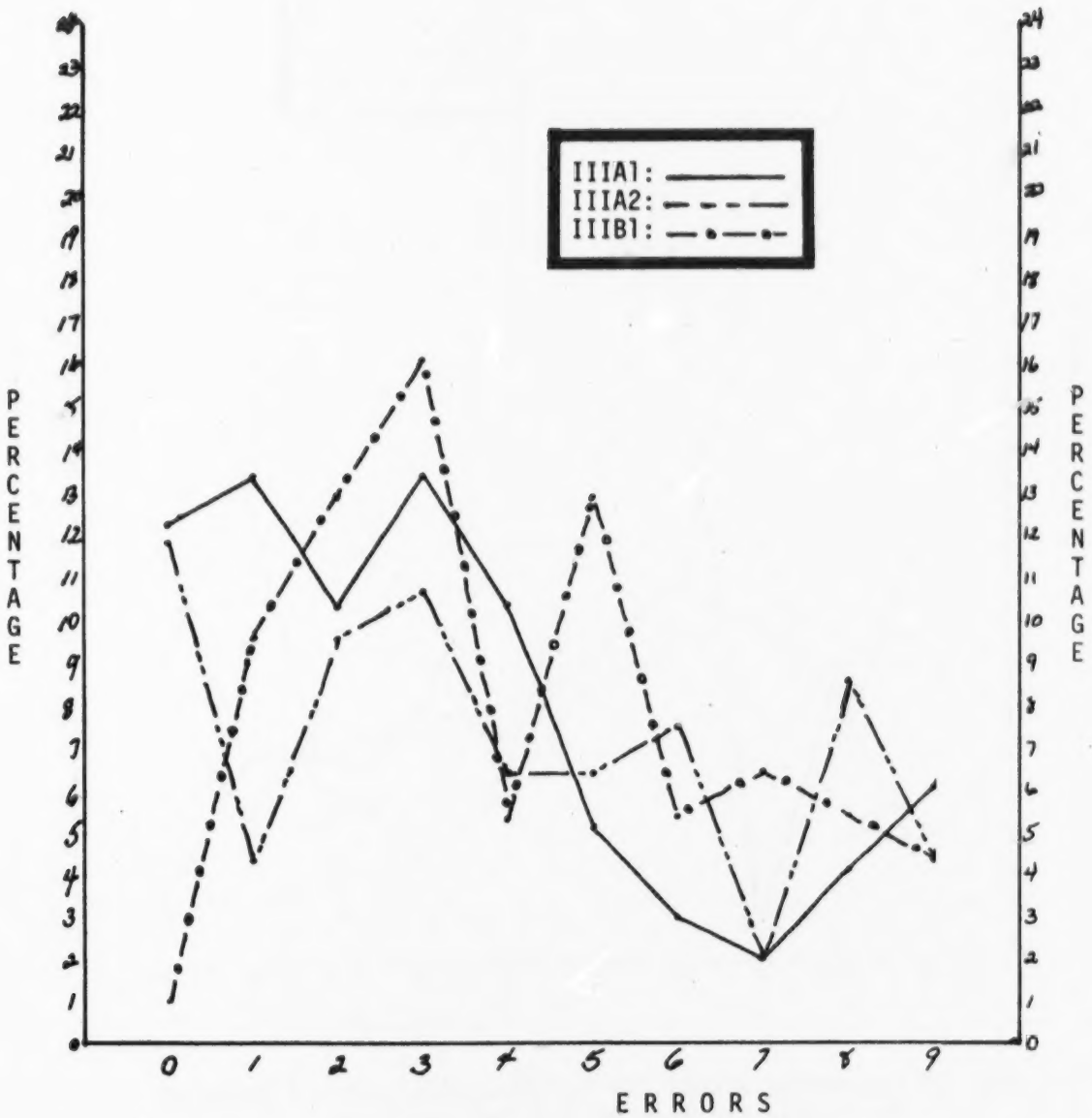

FIG. 5 Percentage errors for Positions in Space Filmstrips for 6 year old hearing-impaired children

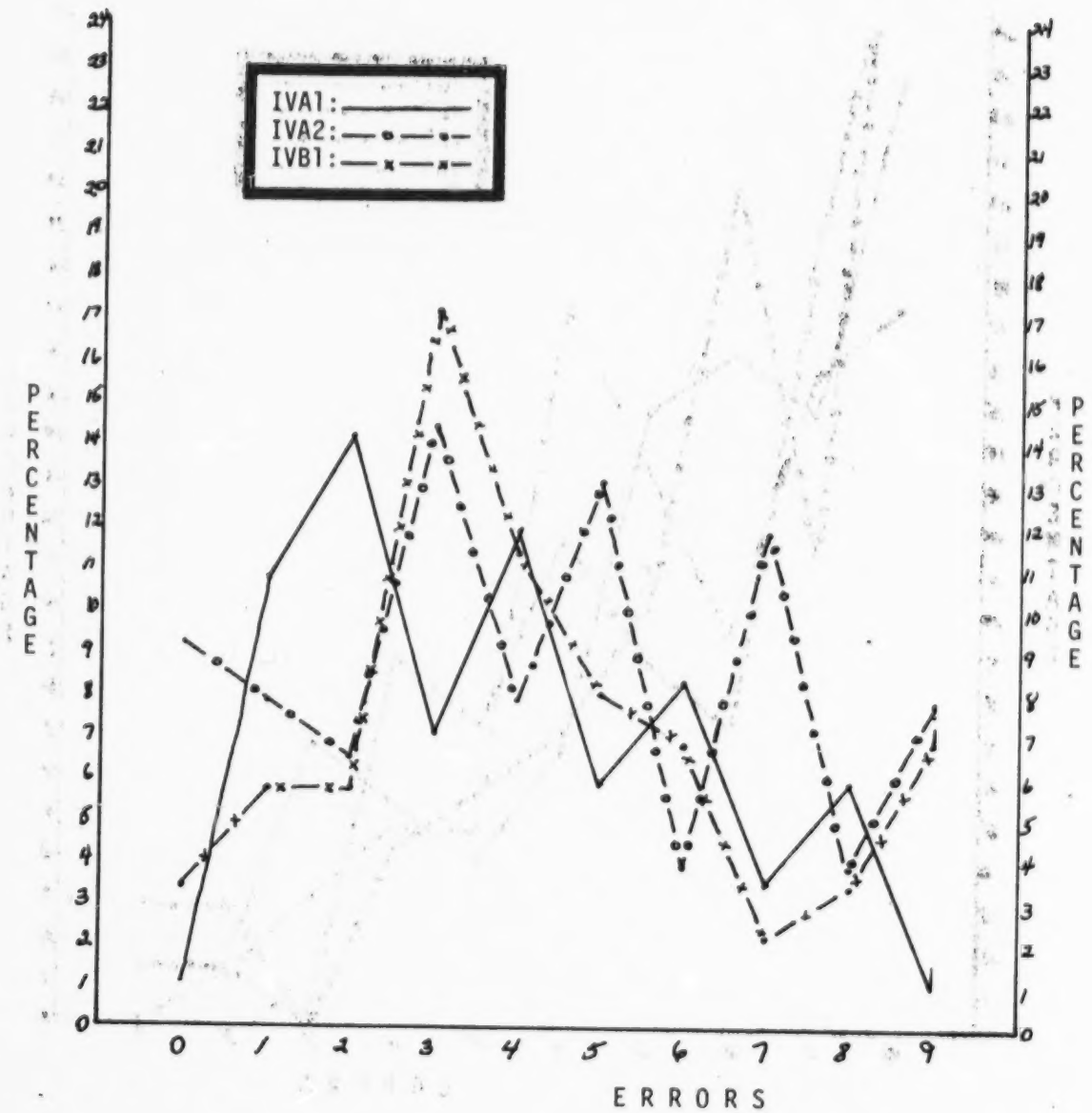

FIG. 6 Percentage errors for Spatial Relationships Filmstrips for 6 year old hearing-impaired children

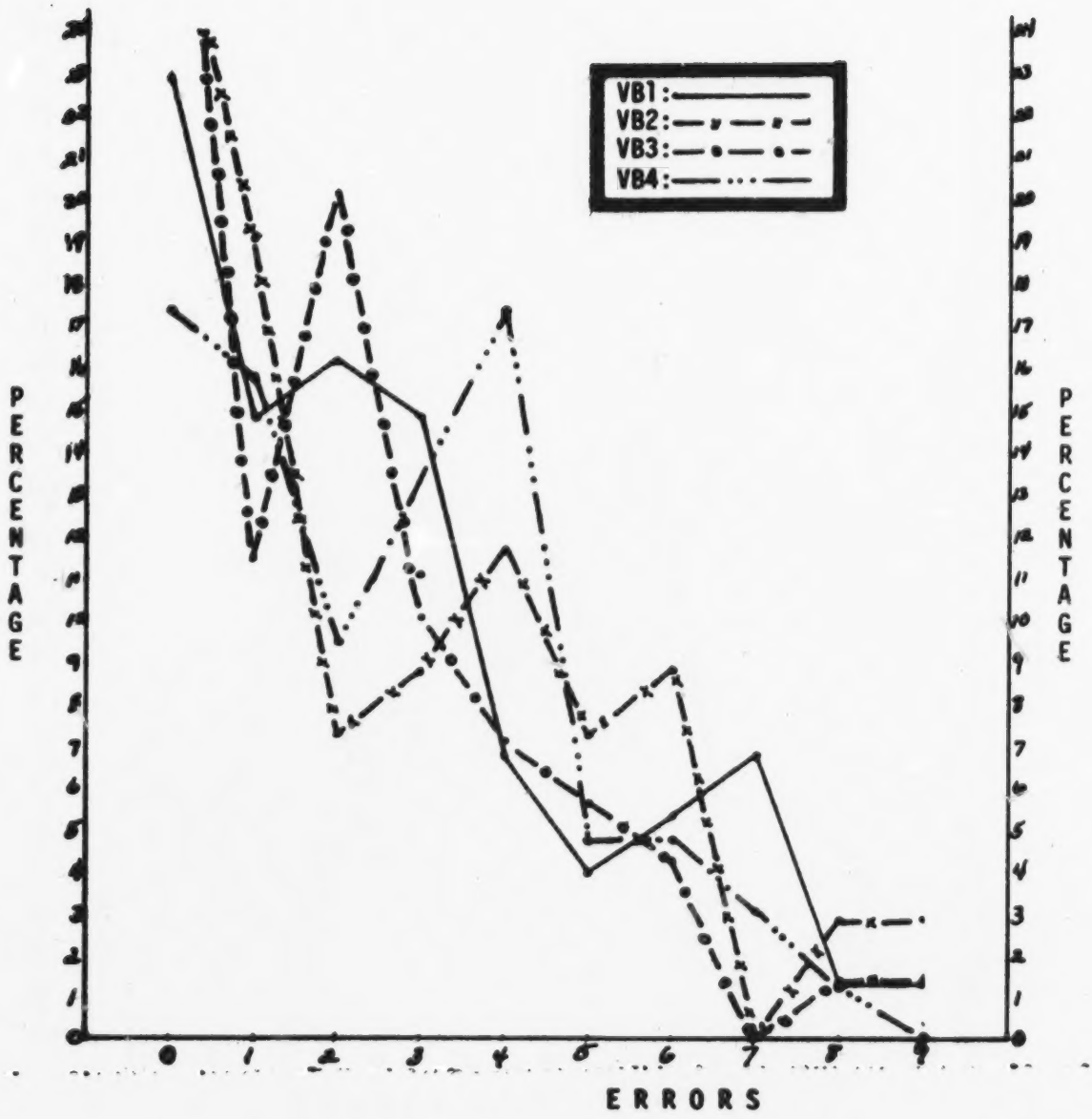

FIG. 7 Percentage errors for Figure-Ground Filmstrips for 6 year old hearing-impaired children

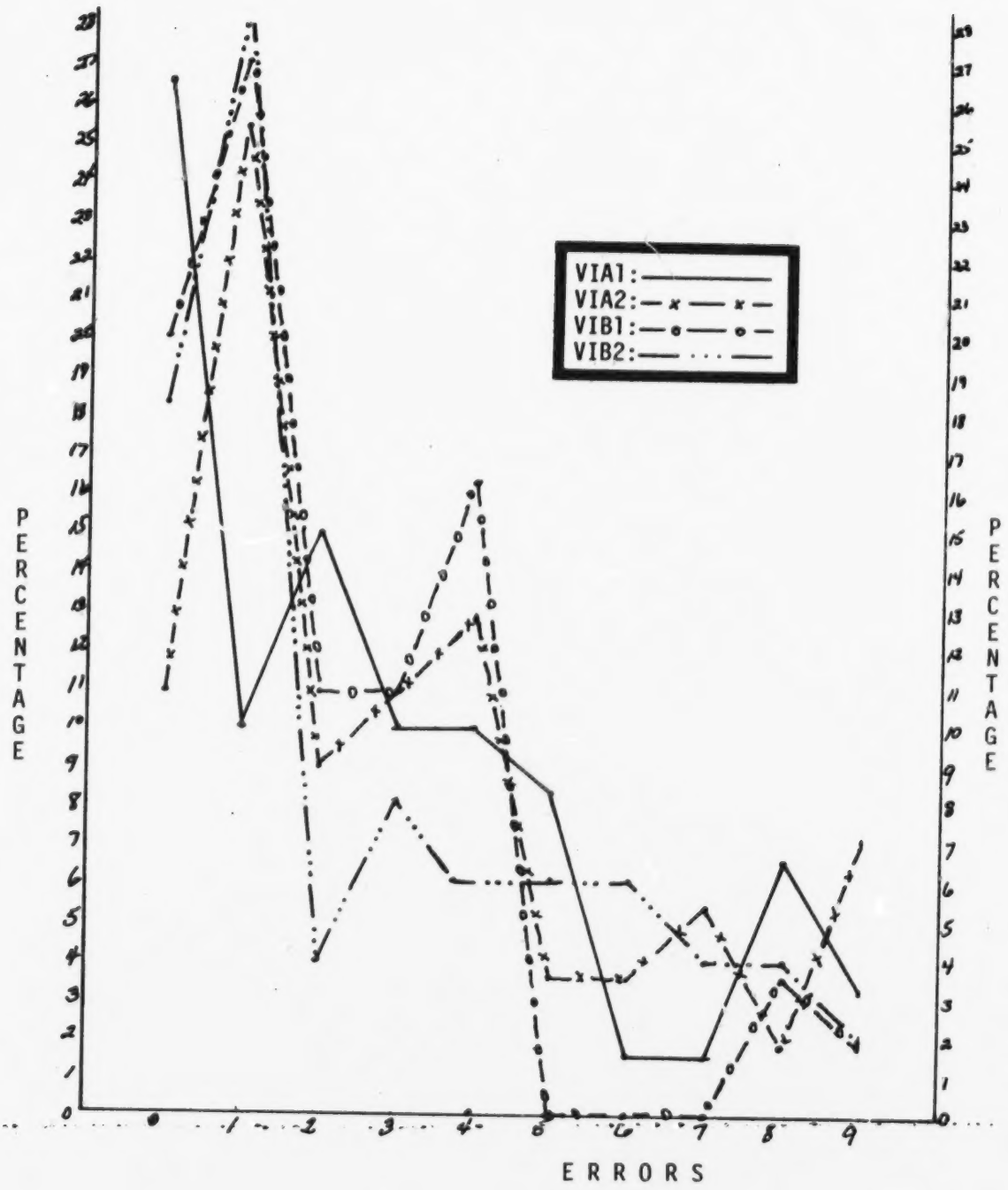

FIG. 8 Percentage errors for Supplementary Filmstrips for 6 year old hearing-impaired children

APPENDIX A

Perceptual Training - Unit Outline of Field Test Filmstrips

Project LIFE

1201 Sixteenth Street, N.W. Washington, D.C. 20036

PERCEPTUAL TRAINING - UNIT OUTLINE

A. Discrimination - which picture of four is different?	B. Association - which picture is identical to or most like a prompting picture?
Introductory Unit	
A1 Introduction to Discrimination (30 frames:RP#1)	B1 Introduction to Association (20 frames:RP#2)
A2 Introduction with Blocks (49 frames:RP#8)	B2 Beginning Matching (40 frames:RP#3)
	B3 Criterion Test (40 frames:RP#4)
Unit I. Visual Properties	
IA1 Color and Shape (52 frames:RP#4)	IB1 Color, Shape, and Size (40 frames:RP#1)
IA2 Color and Size (44 frames:RP#2)	IB2 Color, Shape, Size (generalize) (50 frames:RP#6)
IA3 Color, Shape, and Size (40 frames:RP#6)	IB3 Shape (abstracting) (40 frames:RP#7)
IA4 Mr. Percepto (Supplement) (30 frames:RP#8)	
Unit II. Additions-Omissions	
IIA1 Additions (45 frames:RP#3)	IIB1 Additions-Omissions (40 frames:RP#2)
IIA2 Omissions and Additions (40 frames:RP#5)	IIB2 Additions-Omissions (finer disc) (40 frames:RP#8)
Unit III. Postion in Space	
IIIA1 Inversions (40 frames:RP#4)	IIIB2 Inversions and Reversals (40 frames:RP#5)
IIIA2 Reversals (40 frames:RP#7)	
Unit IV. Spatial Relationships	
IVA1 Distance (40 frames:RP#3)	IVB1 Distance and Placement (40 frames:RP#6)
IVA2 Placement (30 frames:RP#1)	
Unit V. Figure-Ground	
	VB1 Ground on the Prompt (40 frames:RP#6)
	VB2 Ground on the Alternatives (40 frames:RP#7)
	VB3 Ground on Everything (40 frames:RP#6)
	VB4 Ground on Everything (difficult) (40 frames:RP#8)
Unit VI. Supplementary	
VIA1 Word Composition (40 frames:RP#5)	VIB1 Word Configuration and Comp. (55 frames:RP#8)
VIA2 Letter and Word Discrimination (50 frames:RP#4)	VIB2 Letter and Word Discrimination (52 frames:RP#7)

October, 1970

APPENDIX B

Perceptual Training Contents of Field Test Filmstrips

Project LIFE

1201 Sixteenth Street, N.W. Washington, D. C. 20036

PERCEPTUAL TRAINING

Contents

Introductory Unit

Introduction to Discrimination 30 Frames Response Pattern 1

Purpose: To familiarize the student with the operation of the teaching machine and to develop gross discrimination between pictures and configurations.

Behavioral Objectives: The Student: (a) acquires the necessary skills to operate the Program Master (the Project's teaching machine); (b) selects, from four alternatives, the item which is different.

Section A2 - Introduction With Blocks 49 Frames Response Pattern 8

Purpose: To give further assistance to those individual exhibiting difficulty in mastering the use of the Program Master in conjunction with the discrimination task.

Behavioral Objective: The student will depress the button on the Program Master which is identical to the symbol associated with the block which is different.

Introduction to Association 20 Frames Response Pattern 2

Purpose: To familiarize the student with the operation of the Program Master and develop skill in the task of matching.

Behavioral Objective: The student will select the picture or configuration, from a set of four, which is identical to a given picture or configuration.

Section B2 - Beginning Matching 40 Frames Response Pattern 3

Purpose: To provide further assistance to those students experiencing problems with the use of the Program Master in conjunction with a matching task.

Behavioral Objective: The student will depress the button on the Program Master which has the same symbol as that which is under the picture identical to the prompting stimulus.

Section B3 - Criterion Test 40 Frames Response Pattern 4

Purpose: To evaluate the student's perceptual skills in relation to the perceptual training program or to be used as a review.

Objective: The student must select the picture which is an identical match to the prompting stimulus.

Project LIFE

1201 Sixteenth Street, N.W. Washington, D. C. 20036

PERCEPTUAL TRAINING

Contents

Unit 1 - Visual Properties

Section A1 - Color and Shape 52 Frames Response Pattern 4

Purpose: To develop the skill of shape discrimination.

Behavioral Objectives: Given three identical pictures of an object, a form, a letter, or a word and one picture of a different object, form, letter or word; the student will select the one that is different.

Section A2 - Color and Size 44 Frames Response Pattern 2

Purpose: To develop the skill of size discrimination.

Behavioral Objectives: Given three identical pictures of an object, a form, a letter, or a word and one picture which is different because of a change in size; the student will choose the one that is different.

Section A3 - Color, Shape, and Size 40 Frames Response Pattern 6

Purpose: To increase discrimination skills among pictures of real objects, forms, word configurations, configurations with words, and words which differ in size, shape, or pattern.

Behavioral Objectives: From a set of four items, the student will select the one which differs in size, shape, or pattern.

Section A4 - Mr. Percepto (Supplement) 30 Frames Response Pattern 8

Purpose: To reinforce and extend the skill of discrimination among pictures which differ because of the size, shape, or color of some part of the picture while telling a story.

Section B1 - Color, Shape, and Size (Identical Match) 40 Frames Response Pattern 1

Purpose: To develop matching skills using pictures of real objects, forms, word configurations, letters, and words which differ in color, size, shape, or combinations of the three.

Behavioral Objectives: Given a set of four pictures of real objects or meaningless forms which differ because of color, size, shape, or combinations of the three; the student will select the picture which is identical to the prompting stimulus.

Section B2 - Color, Shape, and Size (Some Generalizations) — 50 Frames — Response Pattern 6

Purpose: To extend perception beyond an identical match to a conceptual match.

Behavioral Objectives: Given a picture of an object, a form, a letter, or a word; the student will choose, from among four alternatives which differ in size, shape, color, or any combination of the three, the picture which is identical to or is a conceptual match of the prompting stimulus.

Section B3 - Shape (Some Abstracting) — 40 Frames — Response Pattern 7

Purpose: To assist the development of abstraction by matching on the basis of shape alone.

Behavioral Objectives: Given four pictures of meaningful objects or meaningless forms which differ because of shape or shape and color, the student will select the picture which contains the identical configuration of the prompting stimulus.

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PERCEPTUAL TRAINING

Contents

Unit II - Additions - Omissions

Section A1 - Additions — 45 Frames — Response Pattern 3

Purpose: To acquaint the student with changes because of added features.

Behavioral Objectives: Given three identical pictures of an object, a form, a letter, or a word and one picture which differs because of an added feature, the student will identify the one that is different.

Section A2 - Omissions - With Some Additions — 40 Frames — Response Pattern 5

Purpose: To develop discrimination skills among pictures of objects, forms, configurations, letters and words which differ because of the addition or omission of lines, patterns or letters.

Behavioral Objectives: Given a set of three identical pictures of meaningful objects or meaningless forms, and one picture which differs because of the addition or omission of some part, the student will select the picture which is different.

Section B1 - Additions and Omissions — 40 Frames — Response Pattern 2

Purpose: To develop skill of matching when the alternatives differ because of additions or omissions of lines, patterns, or letters.

Behavioral Objectives: Given two to four pictures of meaningful objects or meaningless forms which differ because of the addition or omission of some part, the student will choose the picture which is identical to the prompting stimulus.

Section B2 - Additions and Omissions (Finer Discrimination) — 40 Frames — Response Pattern 8

Purpose: To improve the skill of matching when the alternatives differ because of the addition or omission of lines, or letters.

Behavioral Objectives: Given two to four pictures of meaningful objects or meaningless forms which differ because of the addition or omission of some part, the student will select the picture which is identical to the prompting stimulus.

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PERCEPTUAL TRAINING

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Unit III - Position in Space

Section A1 - Inversions 40 Frames Response Pattern 4

Purpose: To develop the skill of discrimination among pictures of real objects or meaningless forms which differ because of an inversion.

Behavioral Objectives: Given a set of three identical pictures of real objects or meaningless forms/and one picture which differs because of an inversion of part of or all of the picture, the student will select the picture which is different.

Section A2 - Reversals 40 Frames Response Pattern 7

Purpose: To develop the skill of discrimination among pictures of real objects or meaningless forms which differ because of a reversal.

Behavioral Objectives: Given a set of three identical pictures of real objects or meaningless forms and one picture which differs because of a reversal of part of or all of the picture, the student will select the picture which is different.

Section B1 - Inversions and Reversals 40 Frames Response Pattern 5

Purpose: To improve perceptual skills related to position by using pictures of a real object or a meaningless form which differ because of inversions, reversals, or rotations of the object, form, or part of the form.

Behavioral Objectives: Given two to four pictures of a real object or a meaningless form which differ because of inversions, reversals, or rotations of the object, form, or part of the object or form; the student will choose the picture which is identical to the prompting stimulus.

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PERCEPTUAL TRAINING

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Unit IV - Spatial Relationships

Section 1A - Distance 40 Frames Response Pattern 3

Purpose: To present discriminations among pictures of meaningful objects or meaningless forms which appear to have different distances between items in the picture or between items in the picture and the viewer.

Behavioral Objectives: Given three identical pictures of meaningful objects or meaningless forms and one picture which has an apparent difference in the distance between items in the picture or between items in the picture and the viewer, the student will select the picture which is different.

Section A2 - Placement 30 Frames Response Pattern 1

Purpose: To improve the perception of relationships involving placement.

Behavioral Objectives: Given three identical pictures of meaningful objects or meaningless forms and one picture which differs because of a change in placement among the items within the picture, the student will select the picture which is different.

Section B1 - Distance and Placement 40 Frames Response Pattern 6

Purpose: To improve the perception of the relationships involving distance and/or placement.

Behavioral Objectives: Given four pictures of meaningful objectives or meaningless forms which differ because of a changed relationship of distance and/or placement, the student will choose the picture which is identical to the prompting stimulus.

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Unit V - Figure Ground

Section B - Ground on Prompt 40 Frames Response Pattern 6

Purpose: To assist discrimination in the midst of irrelevant visual material.

Behavioral Objective: The student will identify, from among four alternatives, the picture which matches the prompting stimulus upon which irrelevant lines or dots have been superimposed.

Section B2 - Ground on Alternatives 40 Frames Response Pattern 7

Purpose: To assist discrimination in the midst of irrelevant visual material.

Behavioral Objective: The student will identify, from among four alternatives upon which irrelevant lines or dots have been superimposed, the picture which matches the prompting stimulus.

Section B3 - Ground on Everything 40 Frames Response Pattern 6

Purpose: To assist discrimination in the midst of irrelevant visual material.

Behavioral Objective: With irrelevant lines or dots superimposed on all of the pictures; the student will identify, from among four alternatives, the picture which matches the prompting stimulus.

Section B4 - Ground on Everything (Fine Discrimination) 40 Frames Response Pattern 8

Purpose: To assist discrimination in the midst of irrelevant visual material.

Behavioral Objective: With irrelevant lines or dots superimposed on all of the pictures; the student will identify, from among four alternatives, the picture which matches the prompting stimulus.

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Unit VI - Supplementary

Section A1 - Word Composition 40 Frames Response Pattern 5

Purpose: To improve word discrimination by focusing attentin on the composition of a word and not the configuration alone.

Behavioral Objective: From a set of four configurations or words, the student will select the configuration or word which is different because of its internal composition.

Section A2 - Letter and Word Discrimination 50 Frames Response Pattern 4

Purpose: To provide further practice in letter and word discrimination or to be used as a criterion test.

Behavioral Objective: From a set of four letters or word, three of which are identical, the student will choose the one which is different.

Section B1 - Word Configuration and Composition 55 Frames response Pattern 8

Purpose: To assist word discrimination by leading the student to attend to word composition.

Behavioral Objective: The student will select, from a set of four alternatives, the configuration, word within a configuration, or word which is identical to the prompting stimulus.

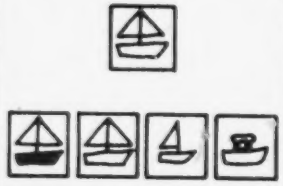
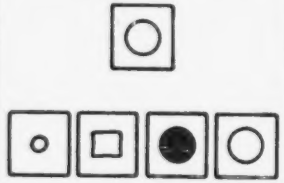
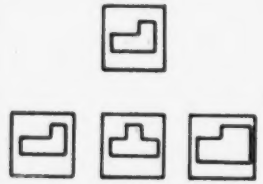
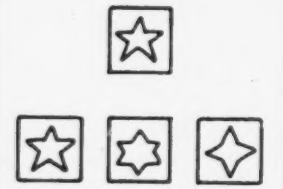
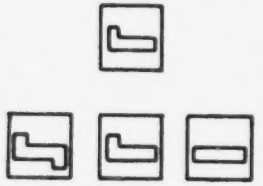
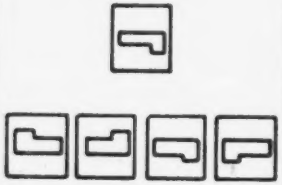
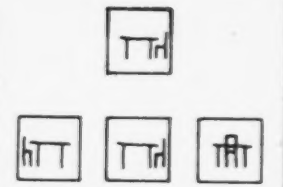
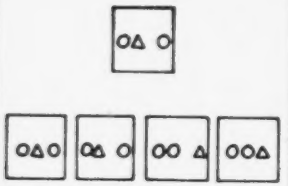
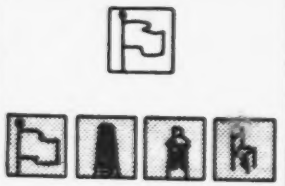
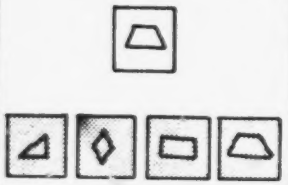
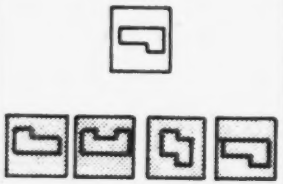
Section B2 - Letter and Word Discrimination 52 Frames Response Pattern 7

Purpose: To provide further practice in letter and word discrimination or to be used as a criterion test.

Behavioral Objective: The student will select, from a set of four alternatives, the letter or word which is identical to the prompting stimulus.

APPENDIX C

Examples of Association Frames in the Visual Perception Areas

Area	Pictures	Geometric Forms	Word Configurations	Letters	Words
Visual Properties				H H H A R	yzk gxh yzk ghx
Additions - Omissions				c o c d a	yoh yoh ych yol
Position in Space				q d b q p	mrp qrm mrq prm mrp
Spatial Relations				vz g v zg zvg vzg vz g	seo eso soe seo eos
Figure - Ground				f f k l	vzg afg ayb vzg ahl

APPENDIX D

Field Test Reporting Forms: D - PL Frame-by-Frame Analysis

D - PL Student Progress

Score Sheet

Name _____ Time:

Age _____ Finish _____

Class _____ Start _____

Date _____ _____

Program xxxxxxxxxxxxxxxxxxxxxx

Unit _____

Strip _____

	□	✚	○	△		□	✚	○	△
1.					31.				
2.					32.				
3.					33.				
4.					34.				
5.					35.				
6.					36.				
7.					37.				
8.					38.				
9.					39.				
10.					40.				
11.					41.				
12.					42.				
13.					43.				
14.					44.				
15.					45.				
16.					46.				
17.					47.				
18.					48.				
19.					49.				
20.					50.				
21.					51.				
22.					52.				
23.					53.				
24.					54.				
25.					55.				
26.					56.				
27.					57.				
28.					58.				
29.					59.				
30.					60.				

TOTAL ERRORS _____

Comments:

Form E-PL

Project LIFE - Programmed Perceptual Training

Student Progress Record
(error count)

Name _____ Age _____

	date	errors		date	errors
Introductory Unit					
A-1			B-1		
A-2			B-2		
			B-3		
Unit I Visual Properties					
IA1			IB1		
IA2			IB2		
IA3			IB3		
IA4					
Unit II Additions-Omissions					
IIA1			IIB1		
IIA2			IIB2		
Unit III Position in Space					
IIIA1			IIIB1		
IIIA2					

Form E-PL (side 2)

	date	errors		date	errors
Unit IV			**Spatial Relationships**		
IVA1			IVB1		
IVA2					
Unit V			**Figure-Ground**		
			VB1		
			VB2		
			VB3		
			VB4		
Unit VI			**Supplementary**		
VIA1			VIB1		
VIA2			VIB2		

Comments:

APPENDIX E

Revisions Made on Visual Perceptual Filmstrips Based on Field Evaluation

REVISIONS

VISUAL PERCEPTUAL

Notes on the field test evaluation forms and the proceedings of the Project LIFE research conference indicated desirable change of specific frames within filmstrips and length of some of the filmstrips. Staff evaluation of the filmstrips resulted in changes being made. These changes are listed below:

Program (Field test I.D.)	Changes
Introduction to Discrimination	Larger picture of a bus on frames 8, 20, and 21.
Introduction to Blocks	Shorten to 49 frames -- resequenced from frame 22 to frame 49. Better color contrast of blocks.
Criterion Test	Add difficult ground to all pictures on frame 32.
Color and Shape (1-A1)	Delete frames 49 through 52.
Color and Size (1-A2)	Errors were noted for frame 18. However, there was nothing noticeably wrong with this frame. One picture was definitely larger than the other three which were all the same size.
Color, Shape, and Size (1-B2)	Omit frames 45 through 50.
Omissions and Additions (II-A2)	Place internal patterning in the four choices: vertical only for three choices; vertical and horizontal for the plus picture.
Additions - Omissions (II-B1)	Use blue pattern on frame 26 the same as used in frame 11 which shows up better than the red pattern.
Addition - Omission (II-B2)	Remove the button of the sweater on the circle choice of frame 7. Darken the yellow on frame 14.

APPENDIX F

Comparison of Field Test Filmstrip Identification and the GE/LIFE Identification

GE/LIFE Filmstrip I. D.	No. of Frames	GE/LIFE Filmstrip Title	Project LIFE Field Test I. D.	No. of Frames
Set 1 No. 1	20	Introduction to Association	B1	20
1 2	40	Beginning Matching	B2	40
1 3	30	Introduction to Discrimination	A1	30
1 4	49	Beginning Discrimination Training	A2	49
1 5	40	Criterion Test	B3	40
1 6	52	Letter and Word Discrimination	VI B2	52
1 7	55	Word Configuration and Composition	VI B1	55
1 8	50	Letter and Word Discrimination	VI A2	50
1 9	40	Word Composition	VI A1	40
2 1	48	Shape Discrimination	I-A1	52
2 2	44	Size Discrimination	I-A2	44
2 3	40	Matching by Color, Shape and Size	1-B1	40
2 4	44	Conceptual Matching	1-B2	50
2 5	40	Shape Generalizations and Compositions	1-B3	40
2 6	40	Size, Shape and Pattern	1-A3	40
2 7	30	Visual Properties - Supplement "Mr. Percepto"	1-A4	30

GE/LIFE Filmstrip I. D.	No. of Frames	GE/LIFE Filmstrip Title	Project LIFE Field Test I. D.	No. of Frames
Set 3 No. 1	40	Ground on the Prompt	V-B1	40
3 2	40	Ground on the Choices	V-B2	40
3 3	40	Ground on all Pictures	V-B3	40
3 4	40	Difficult Grounds on all Pictures	V-B4	40
3 5	45	Additions	II-A1	45
3 6	40	Additions and Omissions	II-A2	40
3 7	40	Additions and Omissions	II-B1	40
3 8	40	Additions and Omissions	II-B2	40
4 1	40	Distance	IV-A1	40
4 2	30	Placement	IV-A2	30
4 3	40	Distance and Placement	IV-B1	40
4 4	40	Inversions	III-A1	40
4 5	40	Reversals	III-A2	40
4 6	40	Inversions and Reversals	III-B1	40

END

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WELFARE
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